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None

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(54) HYDRAULIC CONTAINER AND BLISTER PACK HEAT SEALING MACHINE.

(57) A heat sealing machine for sealing a container or blister pack with film comprises a table 2 for receiving the container, a film unit (figure 1), a sealing unit with a heating element (figure 11) corresponding in shape with the area of the container to be sealed and a hydraulic ram to raise the table upwards to the film unit to effect a seal. The hydraulic ram may also serve to eject the container after sealing by means of the eject bar 3.

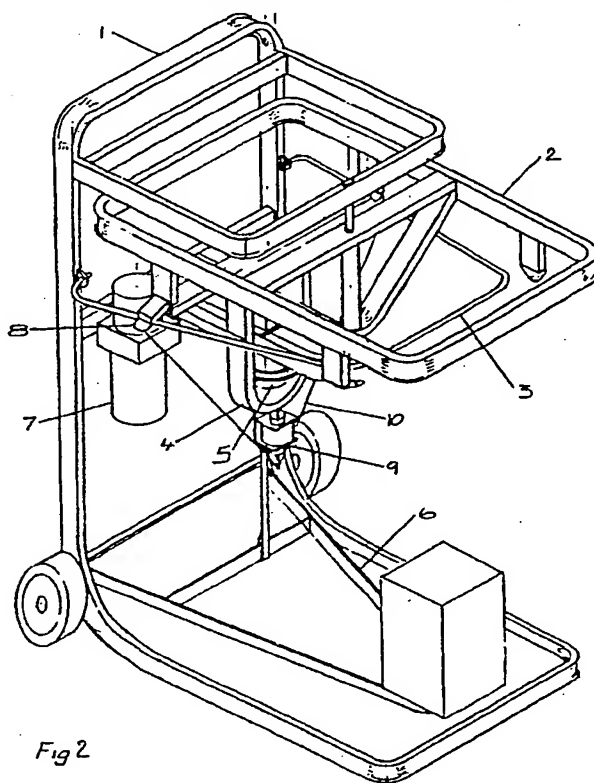


Fig 2

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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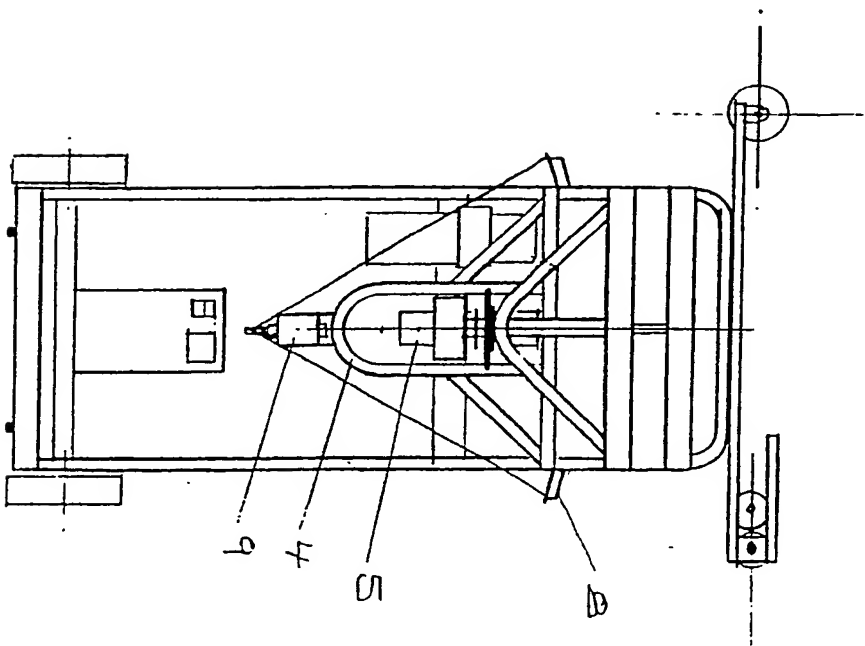
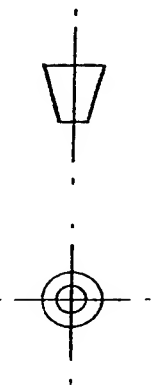
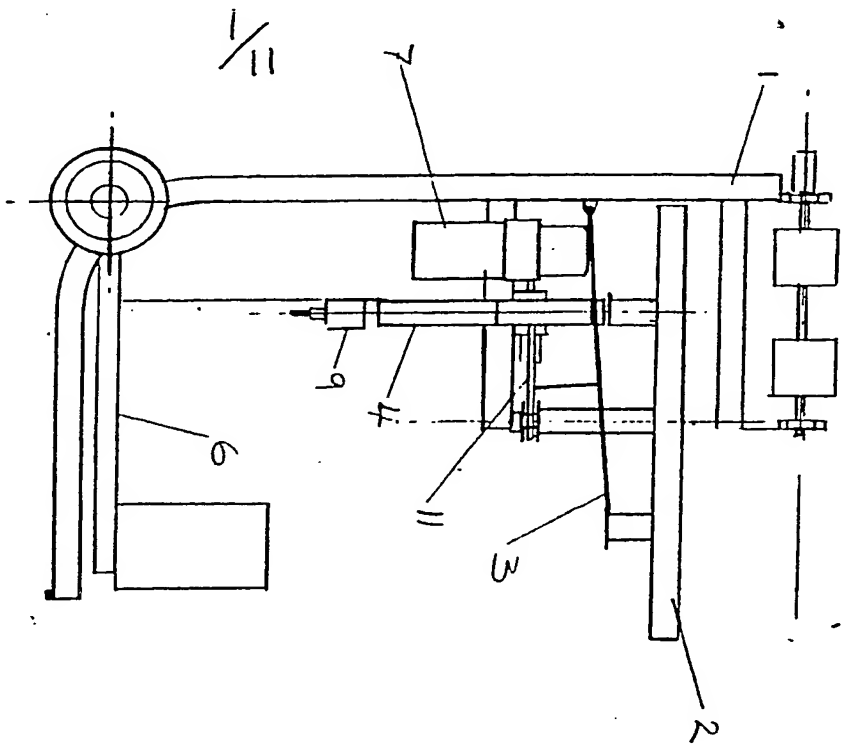


Fig 1

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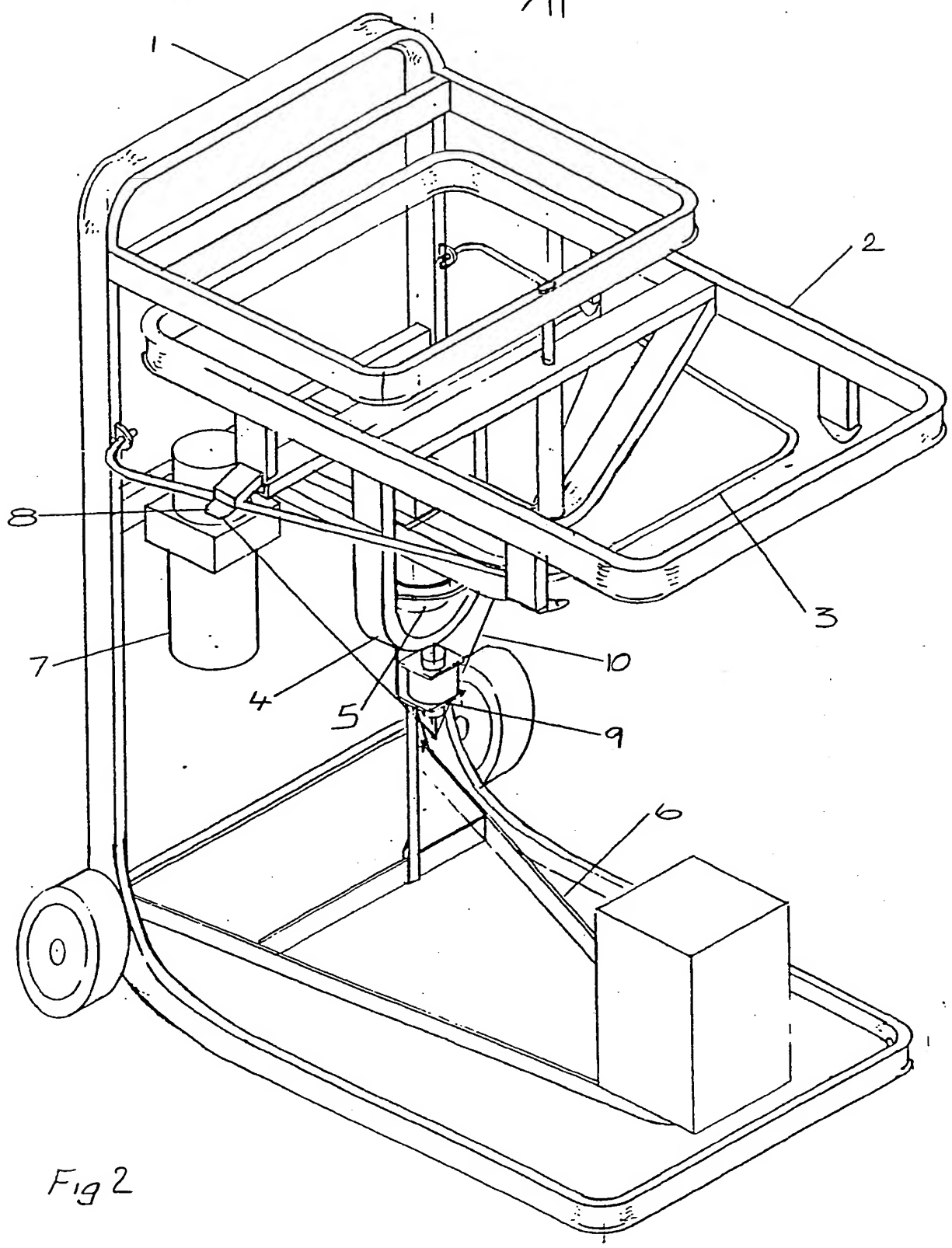


Fig 2

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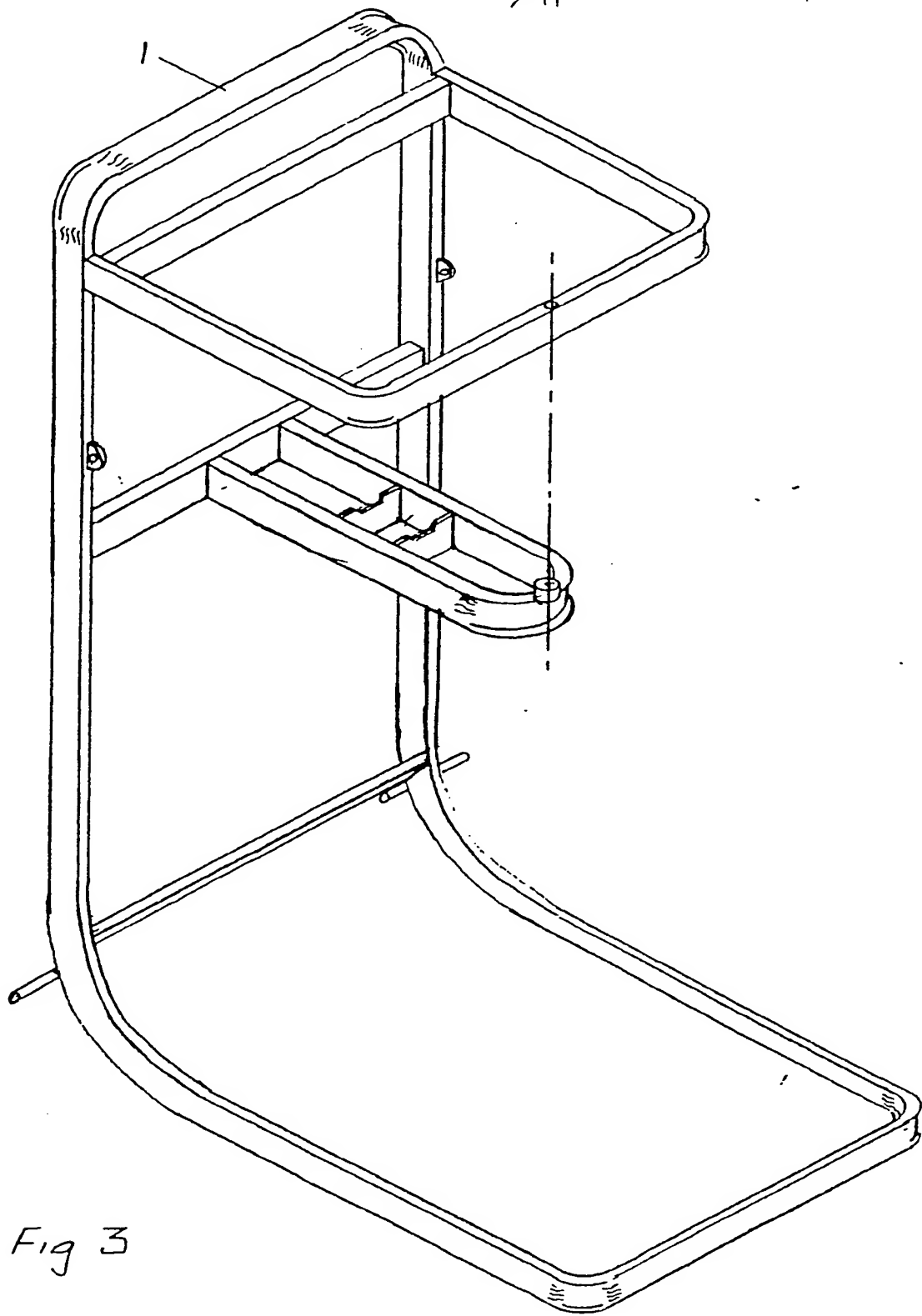


Fig 3

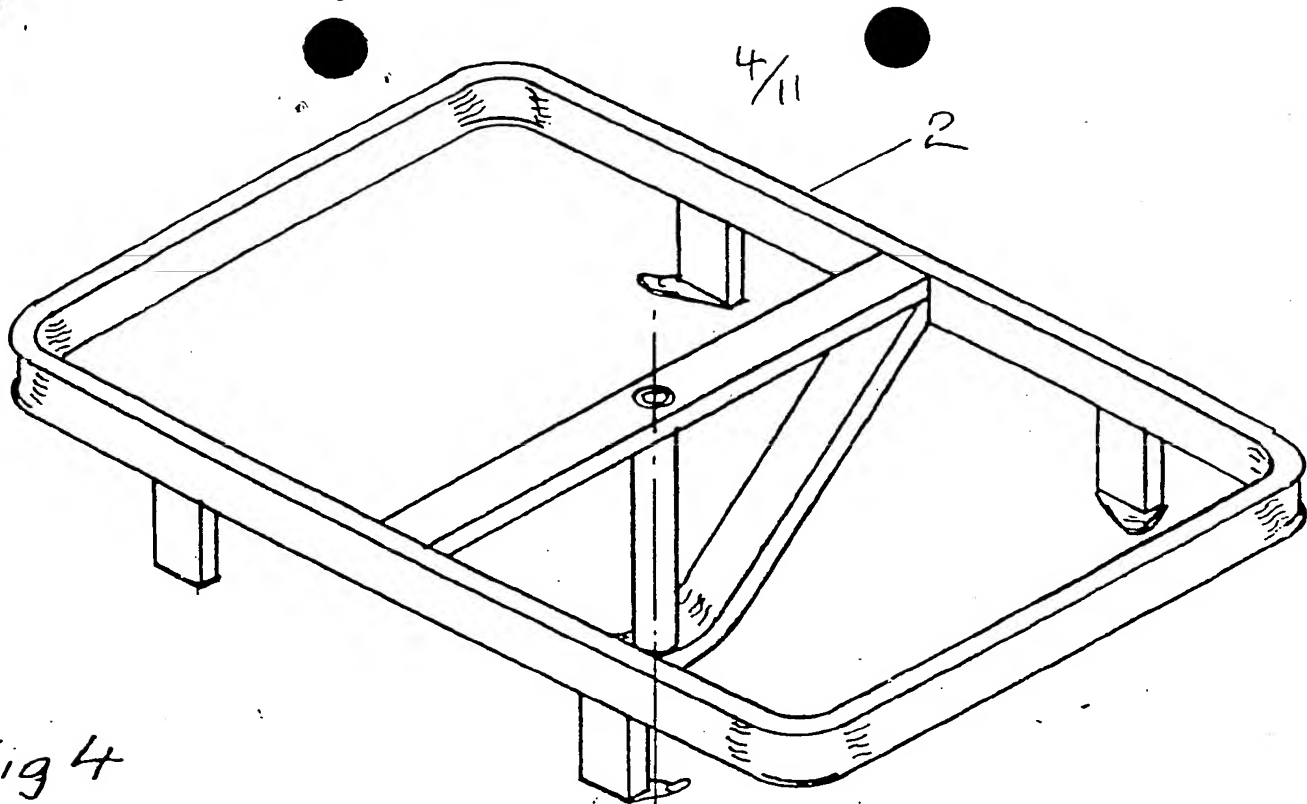


Fig 4

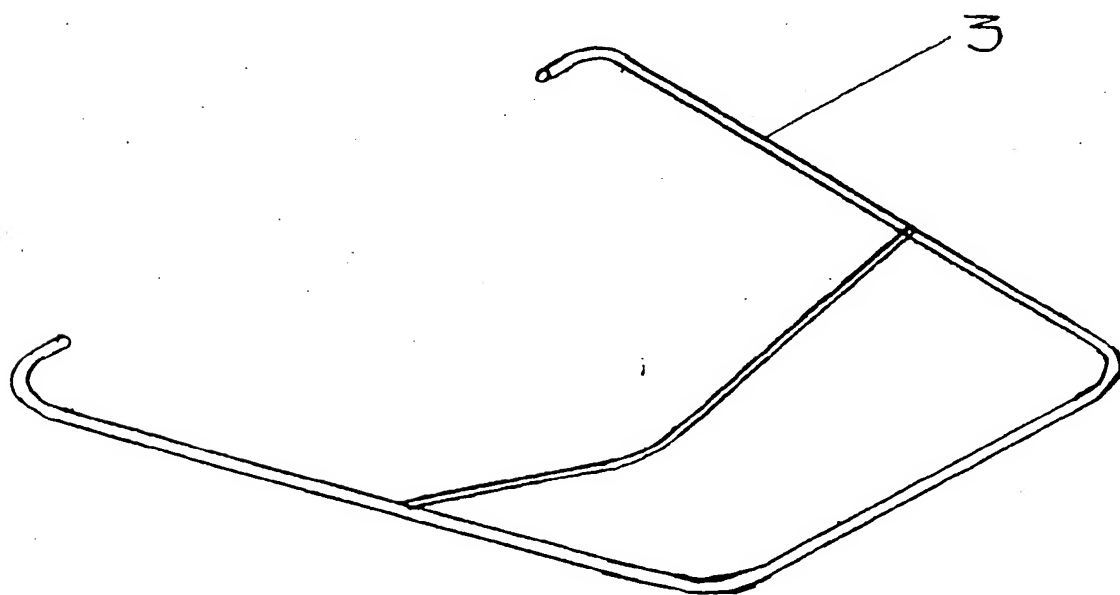
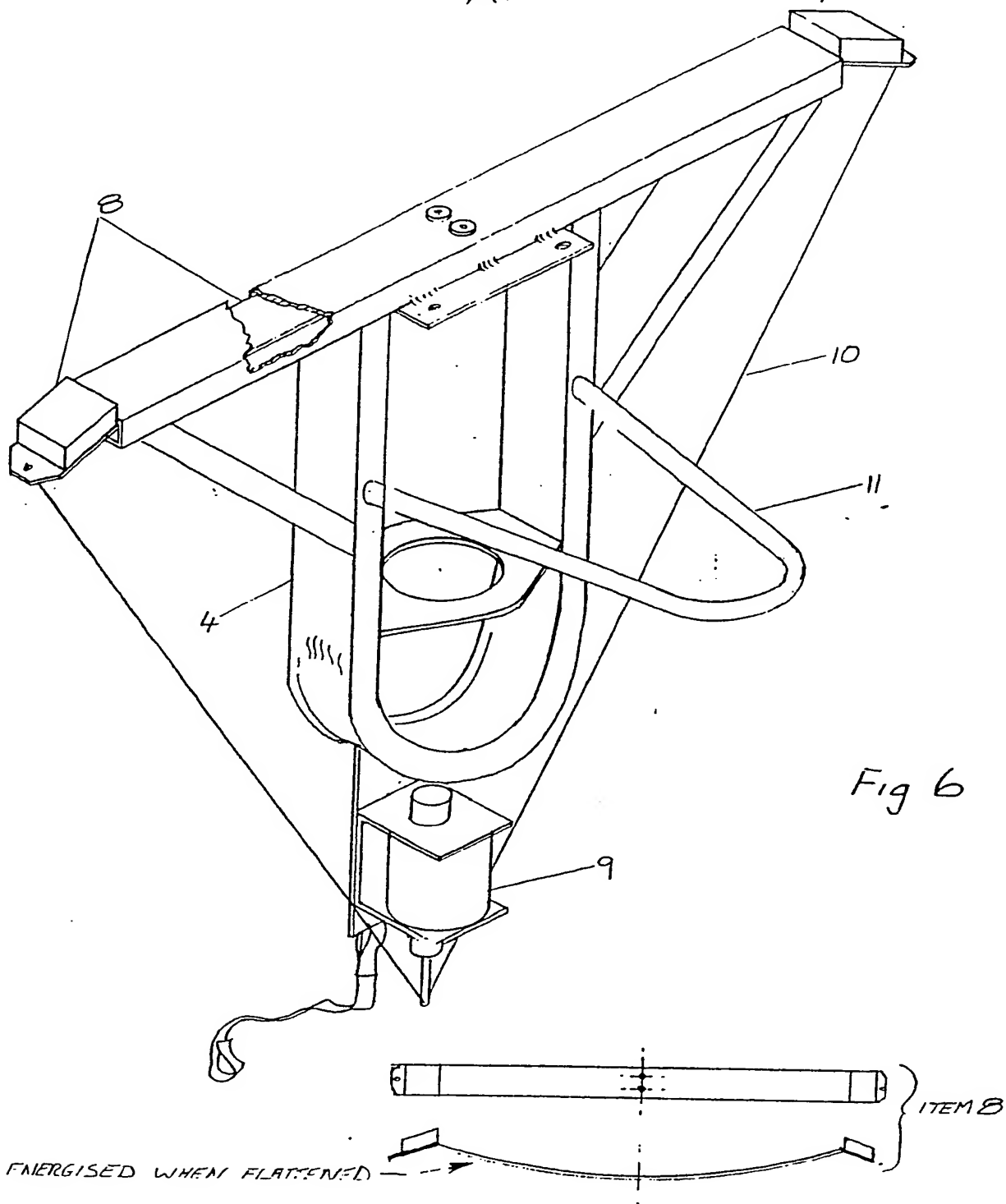


Fig 5

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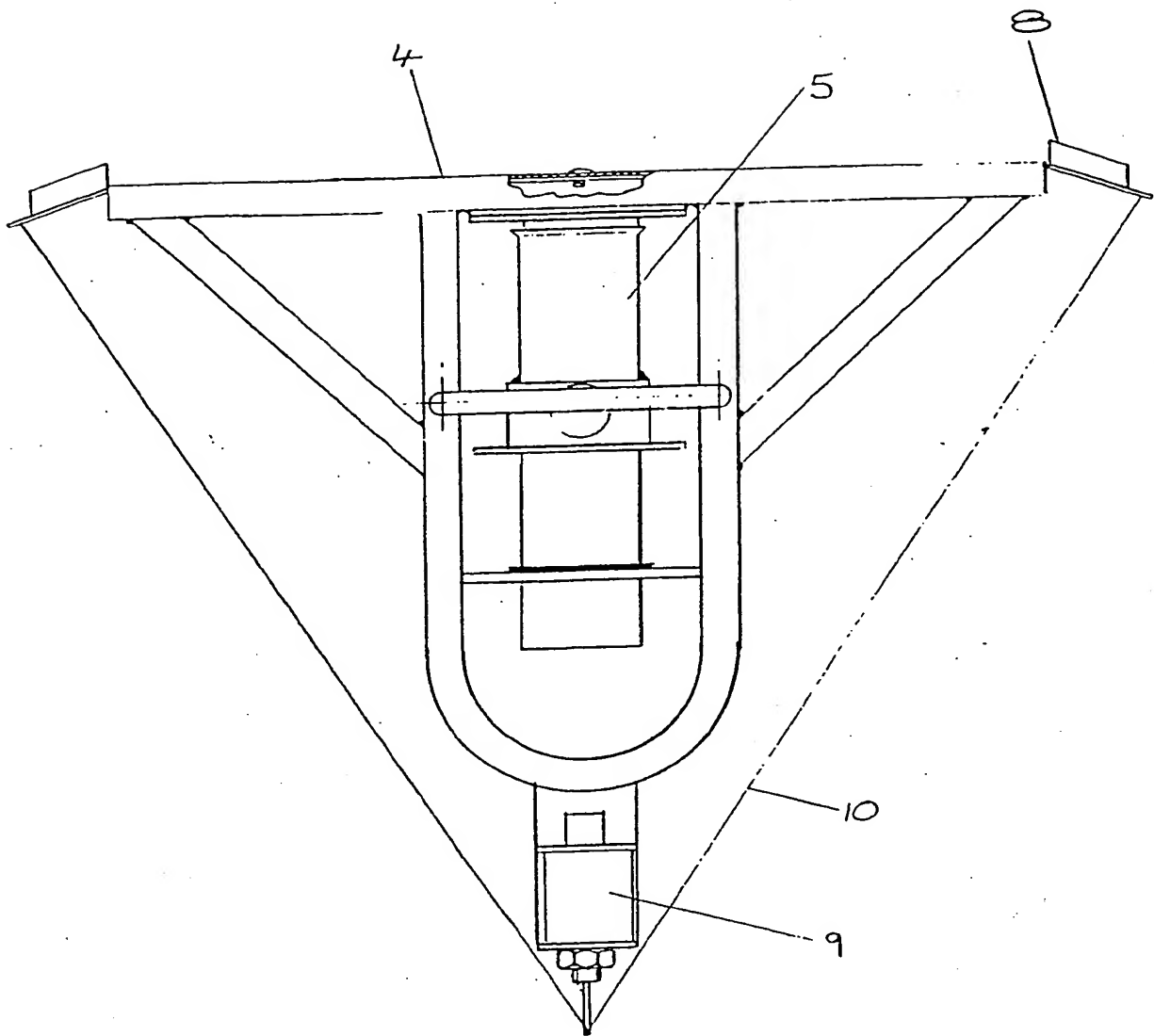


Fig 7

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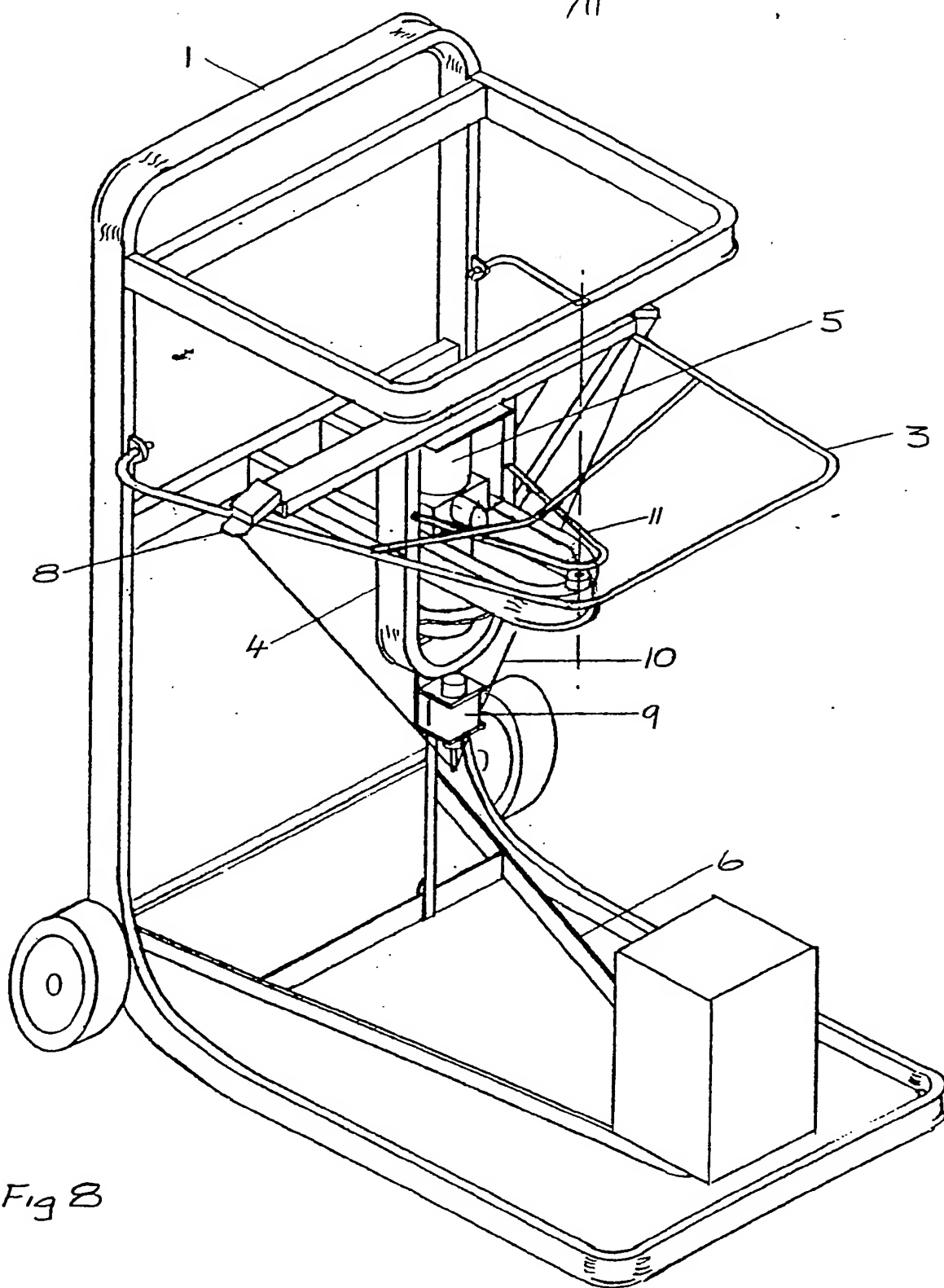


Fig 8

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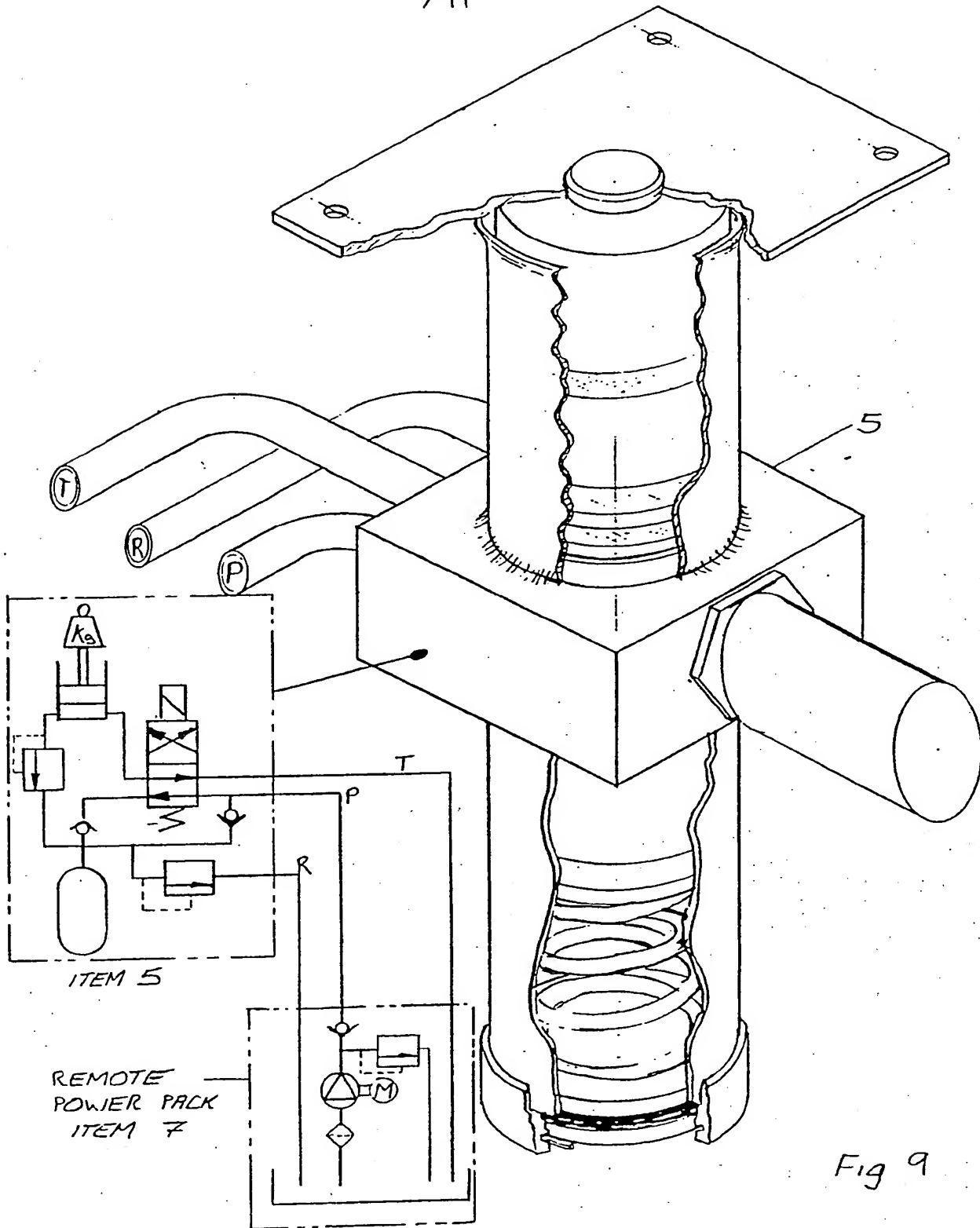
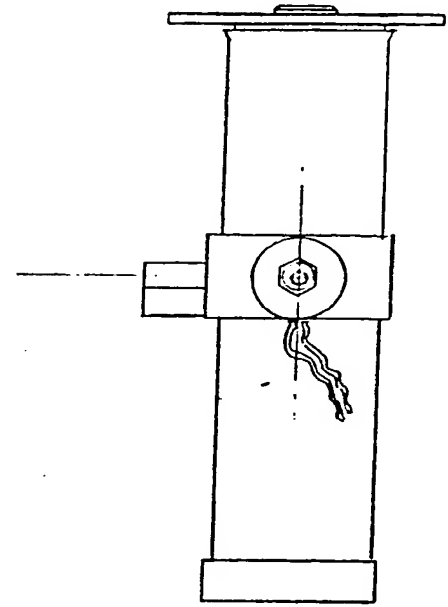
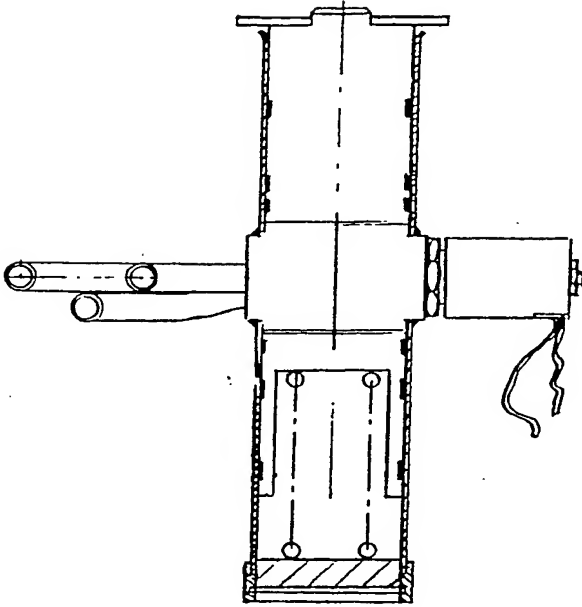
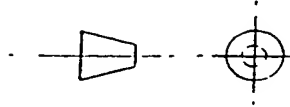


Fig 9

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ITEM 5

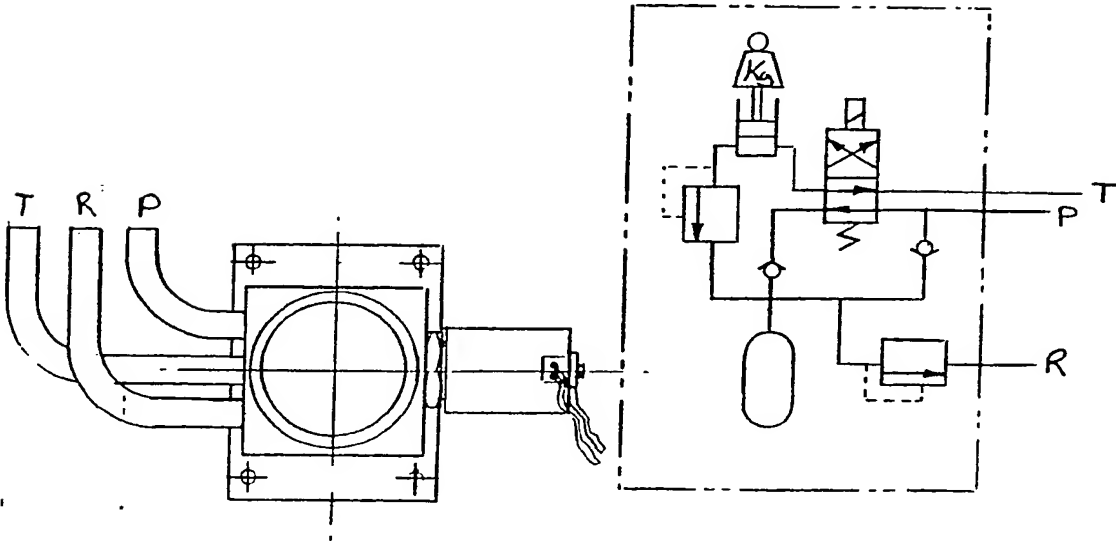
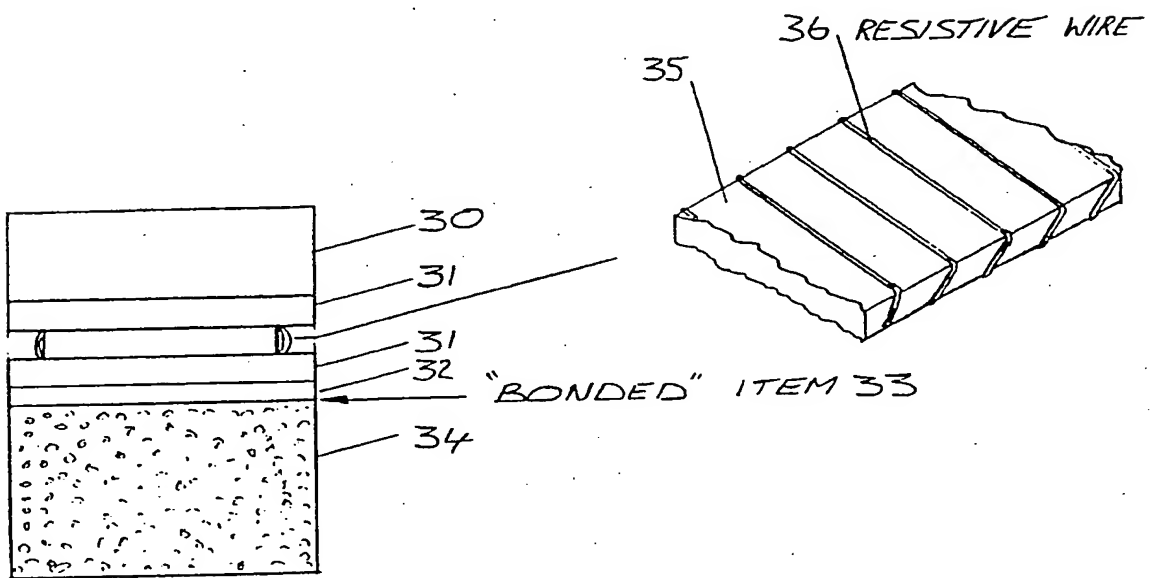
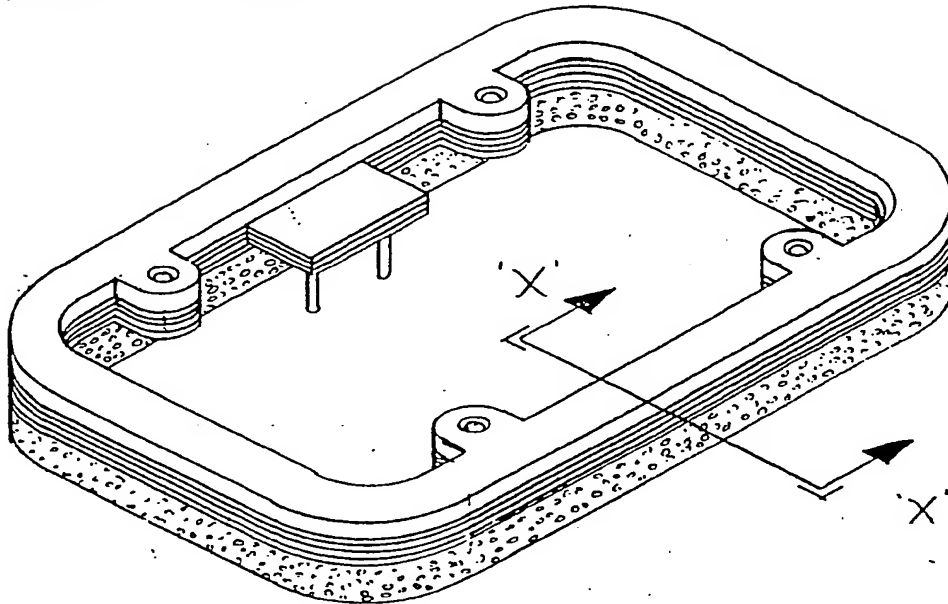


Fig 10

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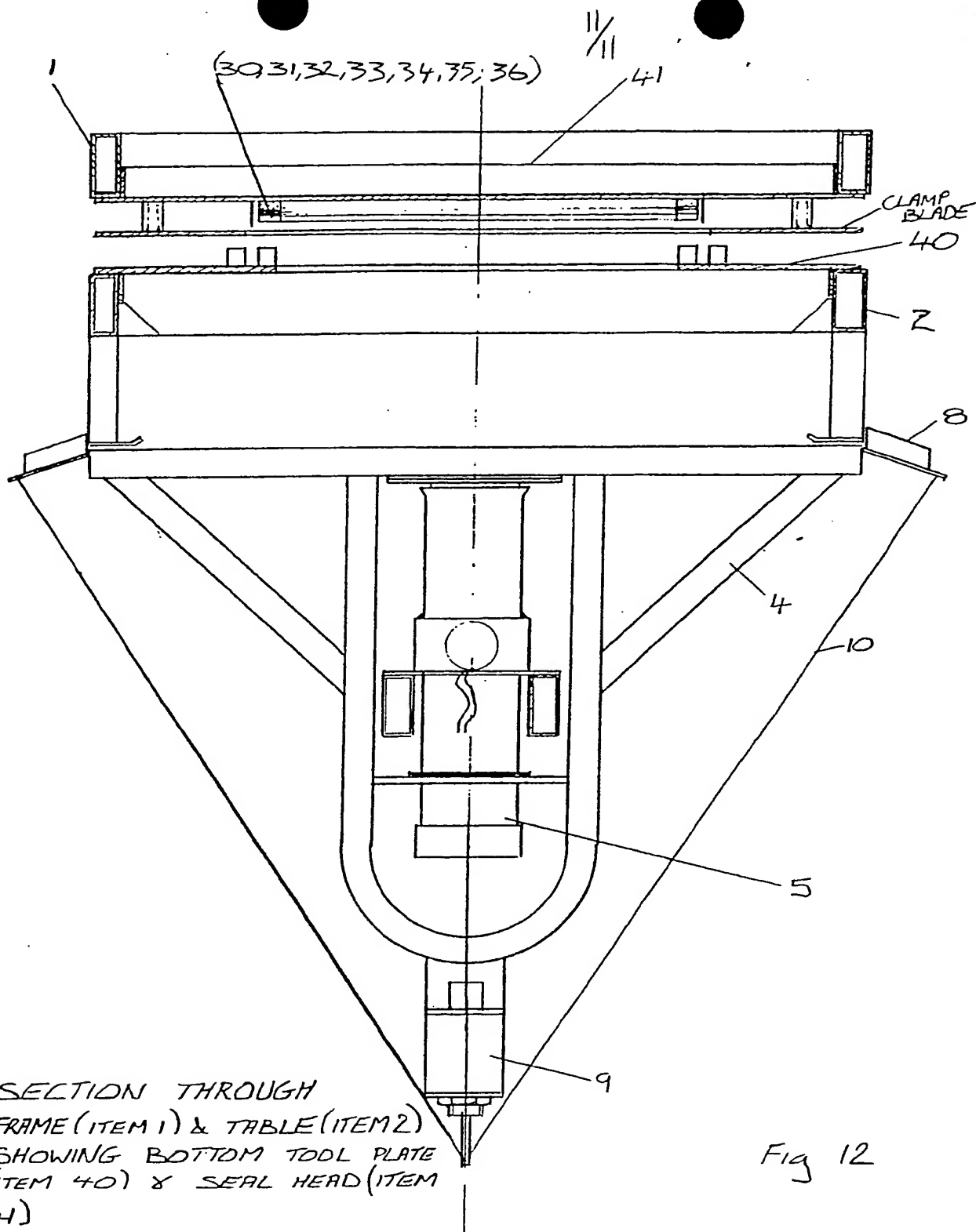
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STANDARD SECTION
SECTION X-X

SCALE - 5:1

Fig 11.



-1-

HYDRAULIC, AUTOMATIC, ALL-ROUND TRIM AND BLISTER PACK, MOBILE HEAT SEALING MACHINE

1: TECHNICAL FIELD

This invention relates to a hydraulic, automatic, all-round trim and blister pack, mobile heat sealing machine.

2: BACKGROUND

There are several all-round trim and blister pack machines on the market. These are used for sealing polyester films to thermoformed PET trays and PET coated board, PVdC, PVC, paper, aluminium foil trays and materials. To the layman; the machine seals typical packaging materials for products like:

1. Microwave and oven plastic pre-formed trays with the plastic film which the convenience foods are packaged in, like the curry sauces, poultry and meat dishes ect. (see appendix 1a)
2. Blister packs, for sealing pre-formed transparent plastic moulds (called blisters) to a coated cardboard. Used widely for packaging screws, hooks ect. in hardware shops, (value added products).

However these machines are expensive to purchase due to their extensive machining design configuration.

Most importantly, they use pneumatics as their pressure medium. Thus consequently needing an auxiliary compressed air supply, or the need to have a integral air compressor in the machine. To achieve the desired force; a large pneumatic cylinder is needed and consequently a large CFM from the compressor, typically 33 litres/minute @ 6 bar.

The machines are production machines and come with special purpose tooling to suit particular trays. The typical operation is as follows:

- 2:1. The pre-formed trays are placed in tooling.
- 2:2. The tooling is indexed into seal station (either by linear or rotary means).
- 2:3. The sealing head comes DOWN [important point to note!] as my design does not! (see Essential Technical features 3:4:3)
The film which is between the seal head and the tooling plate is clamped by a spring loaded clamp plate attached to the seal head (refer to appendix rig. A1.1 for clarification). The clamp blade recedes under spring action and the heating element sandwiches the film to the tray; beginning the welding process. The sealing head continues to compress thus continuing to recede the clamp plate and now the heating element which are both independently sprung, to expose the trimming blade, which cuts the film between the clamp plate and heating element. The trays are now independent of the film

and the film now has apertures where the trimming process has taken place, the remains of film is called skeletal waste.

- 2:4. The seal head retracts; which is sensed on completion to initiate the skeletal film rewind unit, which winds up the skeletal waste and in doing so pulls through a piece of fresh film (as it is still attached to skeletal film) (see appendix fig. A1:2).
- 2:5. The tooling is indexed again repeating the operation but also ejecting the trays from the previous sealing operation, by a separate remote air cylinder or electrical solenoid.

The heating elements on these machines are machined from solid and cover the whole of the two- dimensional area of the top surface (see appendix fig. A1:3). Even when the area to be sealed is a small percentage of this area, as its only the periphery and any possible webbing that needs to be sealed. Thus the power consumption is great, as they have large mass to heat up.

3: ESSENTIAL TECHNICAL FEATURES OF PATENT APPLICATION

Although the machine does the same function as the machines on the market. This invented mechanism does the same function for a fraction of the current market values; and which is a truly independent unit with the exception of an domestic 13A electrical supply.

There are four specific inventive features which desire protection in order of priority, these will now be described by way of example with reference to the accompanying drawing in which:-

Figure 1 shows front and side elevation of the general assembly of the hydraulic,automatic, all-round trim and blister pack, mobile heat sealing machine. (inclusive of the film feed/rewind unit).

Figure 2 shows in perspective, the hydraulic,automatic, all-round trim and blister pack, mobile heat sealing machine. (exclusive of the film feed/rewind unit for clarity).

Figure 3 shows in perspective, the main frame.(item 1)

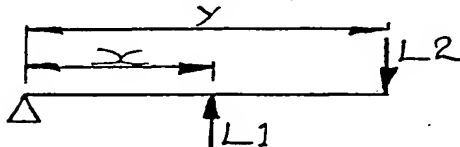
Figure 4 shows in perspective, the table frame.(item 2)

Figure 5 shows in perspective, the eject bar (mechanical movement amplifier).(item 3)

Figure 6 shows in perspective, the thrust bar (item 4) complete with table latch leaf spring (item 8) with the attached pull wire (item 10) connected through "push" solenoid (item 9). Note! item 11 the stress alleviating bar (described in 3:3:4).

Figure 7 thrust bar (item 4) assembled with integrated hydraulic linear ram / accumulator, management block (item 5), front elevation.

Figure 8 shows in perspective, the arrangement of the main frame (item 1), with thrust bar (item 4) and eject bar (item 3). The thrust bar (item 4) is connected to the transformer wishbone (item 5) via a strap or rope. The transformer wishbone has been designed to give a mechanical moment advantage.



$$x * L1 = y * L2 \text{ (for equilibrium)}$$

Figure 9 shows in perspective, the integrated hydraulic linear ram / accumulator, management block (item 5) complete with hydraulic schematic.

Figure 10 the integrated hydraulic linear ram / accumulator, management block (item 5) complete with hydraulic schematic.

Figure 11 shows in perspective, a arbitrary heating element profile made from (item 30,31,32,33,34,35,36); and the standard construction and section of the heating element.

3:1. Item 5; The integrated hydraulic linear ram / accumulator, management block. This is a special purpose, designated article which manages the flow and pressure in a economical method depending on the specific time in its operation. Fig. 9 & 10 shows item 5 complete with schematic diagram of hydraulic circuit.

The operation of its function is as follows:

- 3:1:1 Hydraulic oil is continuously being pumped into unit.
- 3:1:2 When the 4 way, 2-position solenoid criss cross directional cartridge valve (standard product), is not energised the oil flows into the accumulator via a non-return valve, which allows fluid to enter the accumulator, but not exit. The accumulator stores fluid under pressure from 1.5 bar to 6.5 bar @ 40.97cm³.
- 3:1:3 When Accumulator piston bottoms out; the pressure can only reach 6.6 bar before the accumulator pressure relief valve operates and returns further fluid entering the accumulator to the pump tank. This is to achieve a minimum idling power and maximise efficiency and consequently reduce pump wear.
- 3:1:4 When the 4 way, 2-position solenoid criss cross directional cartridge valve (standard product), is energised. The oil flows directly into the linear

actuator ("ram") causing the piston to displace. The oil comes from the stored oil in the accumulator under pressure via the second non-return valve; which allows fluid to exit the accumulator but not enter. This allows for a smaller duty pump to achieve the required displacement in a specific time. Thus the pump takes 4 seconds to pump the required volume to displace the linear actuator; however this work is stored in the accumulator to achieve the displacement in 0.5 - 1.0 second (dependent on temperature of oil and viscosity). This gives good and adequate operation times. Also it allows the use of a cheap power pack because the duty cycle of the motor increases greatly because of the low load on the motor. It also allows for a small reservoir on the power pack because the oil flows through a large cooling path, being the tube to the item 5, item 5 itself and the return tube to the power pack item 7.

- 3:1:5 When the actuator bottoms out or builds up to sealing pressure the linear actuator pressure relief valve operates and dumps further oil entering the linear actuator into the accumulator. This maximises the use of stored energy; by storing the excess energy when sealing for use in the next sealing cycle. Thus the right amount of energy is used only when it is needed, and that energy is instantaneous.
 - 3:1:6 The invention of item 5; in its design gives support and accurate location of the thrust bar item 4. . The location comes from the linear actuator piston to the top rail of thrust bar; and from the accumulator out side body to the thrust bar wear ring. This minimises the side thrust of thrust bar and also linear guidance.
- 3:2 Heating element construction. The advantages of this construction are listed as follows: (refer to fig.11)
- 3:2:1 Low cost construction
 - 3:2:2 Low power consumption. As the element only heats up the area where the seal is going to be made, and the heat sink where the element comes in contact with the film, which is made from aluminium. is only 3.2mm thick.
 - 3:2:3 The element has a silicone sponge energy absorber bonded to the back. This absorbs the compression when sealing and self aligns its self with the tray allowing small discrepancies in parallelism between bottom tooling (item 40) and seal head (item 41) Fig 12 . The silicone sponge offers attachment to the seal head and also acts as a important insulator, keeping the heat energy in the element and drastically reducing heat loss through conduction to the rest of the sealing head

The construction consists of :

| | | |
|--|---------|--|
| 3.2mm thick aluminium heat sink, | item 30 | All sandwiched together and fastened with countersink pop rivets in pre-determined locations |
| 1.0mm thick Mica board sandwich plate, | item 31 | |
| 1.0mm thick Mica board, element wrap, | item 35 | |
| resistance wire wrapped round | item 36 | |
| 1.0mm thick Mica board sandwich plate, | item 31 | |
| 0.7mm thick stainless steel back plate | item 32 | |
| 6.4mm thick silicone sponge sheet | item 34 | (bonded to item 32 with a silicone RTV cement item 33) |

3:3 Thrust bar and table latch. According to this invention; the thrust bar and table latch offer the below functions:

3:3:1 Transmits load from the hydraulic linear actuator to the table in a light construction form.

3:3:2 Locks the table in position, by means of a unique leaf spring mechanism item 8. Which is activated through a unique arrangement using a solenoid and wire item 9 and item 10 respectively.

3:3:3 Is accurately guided by item 5 (see 3:1:6 for further explanation).

3:3:4 Lifts the table up from the centre under minimum table load alleviating any moments from off centre force using item 11. When the table tooling item 40 comes in contact with seal head item 41 Fig 12; item 11 flexes to begin transmitting the load central to the thrust bar again alleviating any moments.

3:3:5 The thrust bar configuration; allows item 5 to be utilised to eject packaging from the front table tool station, by means of mechanical amplification (item 3) of movement. Thus one linear actuator does two jobs. This is a unique feature.

3:4 Frame and table configuration and construction. The frame item 1 and table item 2; is made from a light gauge rectangular mild steel tube (1.2mm thk wall). They are formed into the desired shape by "crush" bends which means the main table and frame sections have only one joint. This gives rise to faster production methods, accuracy and aesthetic appeal. The configuration of each component and their relationship with each other, interact to give a end function.

These are:

3:4:1 Relationship of thrust bar item 4 to table item 2 and

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eject bar item 3 . (discussed in 3:3:1, 3:3:3, 3:3:4 and 3:3:5).

3:4:2 Relationship between transformer Wish bone Item 6 to frame item 1 and thrust bar item 4 .

3:4:3 The table is raised up to the seal head where most if not all other machines on the market, have their seal head come down onto the table. The advantage of having the table raise to the seal head are:

3:4:3:1 Film has less travel when being compressed; as the clearance between trays and clamp plate, does not need to be accommodated for. Thus allowing for the removal of tension mechanisms for the film to allow for displacement of seal head.

3:4:3:2 less working parts and contamination of food problems due to leaks directly over the food.

CLAIMS

1. A integrated hydraulic linear ram / accumulator, management block. Designated article which manages the flow and pressure in a economical method depending on the specific time in its operation.
Comprises of a; 4 way, 2-position solenoid criss cross directional cartridge valve (standard product); which diverts oil flow into the accumulator via a non-return valve, or into linear actuator depending on position of valve.
2. A integrated hydraulic linear ram / accumulator, management block as claimed in claim 1; where as when the accumulator piston bottoms out; the pressure can only reach 6.6 bar before the accumulator pressure relief valve operates and diverts further fluid entering the accumulator to the pump tank.
3. A integrated hydraulic linear ram / accumulator, management block as claimed in claim 1 & 2; where as when the solenoid of the 4 way 2-position criss cross directional cartridge valve, is energised. oil flows from accumulator via non-return valve to increase flow into the linear actuator.
4. A integrated hydraulic linear ram / accumulator, management block as claimed in claim 1,2 & 3; where as when the actuator bottoms out or builds up to sealing pressure the linear actuator pressure relief valve operates and dumps further oil entering the linear actuator into the accumulator.
5. A integrated hydraulic linear ram / accumulator, management block as claimed in claim 1,2,3 & 4; where as the design gives support and accurate location of the thrust bar (item 4). The location comes from the linear actuator piston to the top rail of thrust bar; and from the accumulator out side body to the thrust bar wear ring. This minimises the side thrust of thrust bar and also linear guidance.
6. A heating element construction. Where the element is approximately 10mm wide in "section" and is of the below construction:

| | | |
|--|---------|--|
| 3.2mm thick aluminium heat sink, | item 30 | All sandwiched together and fastened with countersink pop rivets in pre-determined locations |
| 1.0mm thick Mica board sandwich plate, | item 31 | |
| 1.0mm thick Mica board, element wrap, | item 35 | |
| resistance wire wrapped round | item 36 | |
| 1.0mm thick Mica board sandwich plate, | item 31 | |
| 0.7mm thick stainless steel back plate | item 32 | |
| 6.4mm thick silicone sponge sheet | item 34 | (bonded to item 32 with a silicone RTV cement item 33) |
| | | |

7. A thrust bar that transmits load from the hydraulic linear actuator to the table in a light construction form.
8. A thrust bar as claimed in claim 7, wherein a leaf spring mechanism (item 8), Locks the table in position. Which is activated using a solenoid and wire arrangement (item 9 and item 10 respectively).
9. A thrust bar and table latch as claimed in claim 7 & 8. Is accurately guided by item 5 as claimed in 1,2,3,4 & 5.
10. A thrust bar and table latch as claimed in claim 7,8 & 9. lifts the table up from the centre under minimum table load alleviating any moments from off centre force using item 11. When under load; item 11 flexes to begin transmitting the load central to the thrust bar, again alleviating any moments.
11. A thrust bar as claimed in claim 7,8,9 & 10. The thrust bar configuration; allows item 5 to be utilised to eject packaging from the front table tool, by means of mechanical amplification (item 3) working of (item 11) of movement. Thus one linear actuator. does two jobs.
12. Frame and table configuration, with respect to the relationship of thrust bar (item 4) to table (item 2) and eject bar (item 3) as claimed in claim 5,7,8,9,10,11.
13. A hydraulic, automatic, all-round trim and blister pack, mobile heat sealing machine substantially as described herein with reference to Figures 1-11 of the accompanying drawings.

Relevant Technical Fields

- (i) UK Cl (Ed.N) B5K (K3A3) B8C (CD7, CU32)
(ii) Int Cl (Ed.6) B29C 65/02, 65/18, 65/20

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE: WPI

Search Examiner
KARL WHITFIELD

Date of completion of Search

Documents considered relevant following a search in respect of Claims :-
1-13

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